Greening Incidence and Greening Vector Population Dynamics in Pokhara

C. Regmi, and T. K. Lama

ABSTRACT. Population dynamics of the greening vector was monitored randomly in selected Eureka Lemon trees over a period of 5 yr in a citrus orchard at Pokhara (altitude 935 m). It was observed that the *Diaphorina citri* population reached its maximum in May, June, and July before the monsoon, and its minimum during the winter. The progression of the disease in the orchard was 12% per year.

Index words. Diaphorina citri, Nepal, mandarin seedlings.

The citrus greening disease (CGD) is a serious problem in Nepal. It was first observed in the citrus orchard of the Horticulture Research Station, Pokhara (Western Nepal), in the mid-sixties, where it had been introduced from India with planting material (9, 10). The greening pathogen has been recently reported to be a gram-negative bacterium (7, 8), and the disease is spread mainly by the vector *Diaphorina citri* Kuw in Nepal, where citrus is traditionally grown as seedlings (12). Infected trees yield five times less than healthy ones. *Diaphorina citri* has been reported from several countries of Southeast Asia and the Arabian Subcontinent (3, 4, 6). It has been previously reported from Nepal (5, 11), but it has not been studied in detail there. This paper reports the population dynamics of *D. citri* in relation to the incidence of greening in the orchard of Pokhara Horticulture Research Station.

MATERIALS AND METHODS

Population dynamics of the greening vector were studied in ten randomly selected Eureka lemon trees at the Horticulture Research Station, Pokhara. Populations on ten twigs collected at different levels from the four geographical quadrants of each tree were recorded. All stages of *D. citri* were counted (a hand lens was used for eggs). Observations were carried out weekly from 1980 to 1985. Meteorological data were also recorded in parallel fashion (fig. 2).

Greening severity was evaluated on a scale of 0 to 4 where; 0 = no greening symptoms, 1 = greening symptoms on up to 25% of the twigs and leaves, 2 = 26-50% canopy symptoms, 3 = 51-75% canopy symptoms, and 4 = more than 75% (showing dieback). Trees in stages 1 and 2 were considered slightly damaged, those rated 3 were moderately damaged, and those in stage 4 were severely damaged.

RESULTS

The population of *D. citri* reached a maximum of 2,500 eggs, 828 nymphs, and 188 adults per 10 twigs during May, June, and July (fig. 1). This is before the monsoon, and during very hot, dry weather (fig. 2). Minimum populations were 120 eggs, 20 nymphs, and one adult per 10 twigs in winter (fig. 1). The multiple peaks of population of eggs and nymphs indicate multiple generations of *D. citri* each year.

A comparative study of greening epidemiology was made in a seedling orchard of mandarins planted in 1973 on a site where greening had destroyed the original trees. Some symptoms were present in 1978. In 1981, 133 of 258 trees were severely affected. By 1986, all but five were destroyed or severely diseased.

DISCUSSION

D. citri prefers a lower altitude (up to 1,200 m above sea level) where hot and dry conditions exist (1, 2).

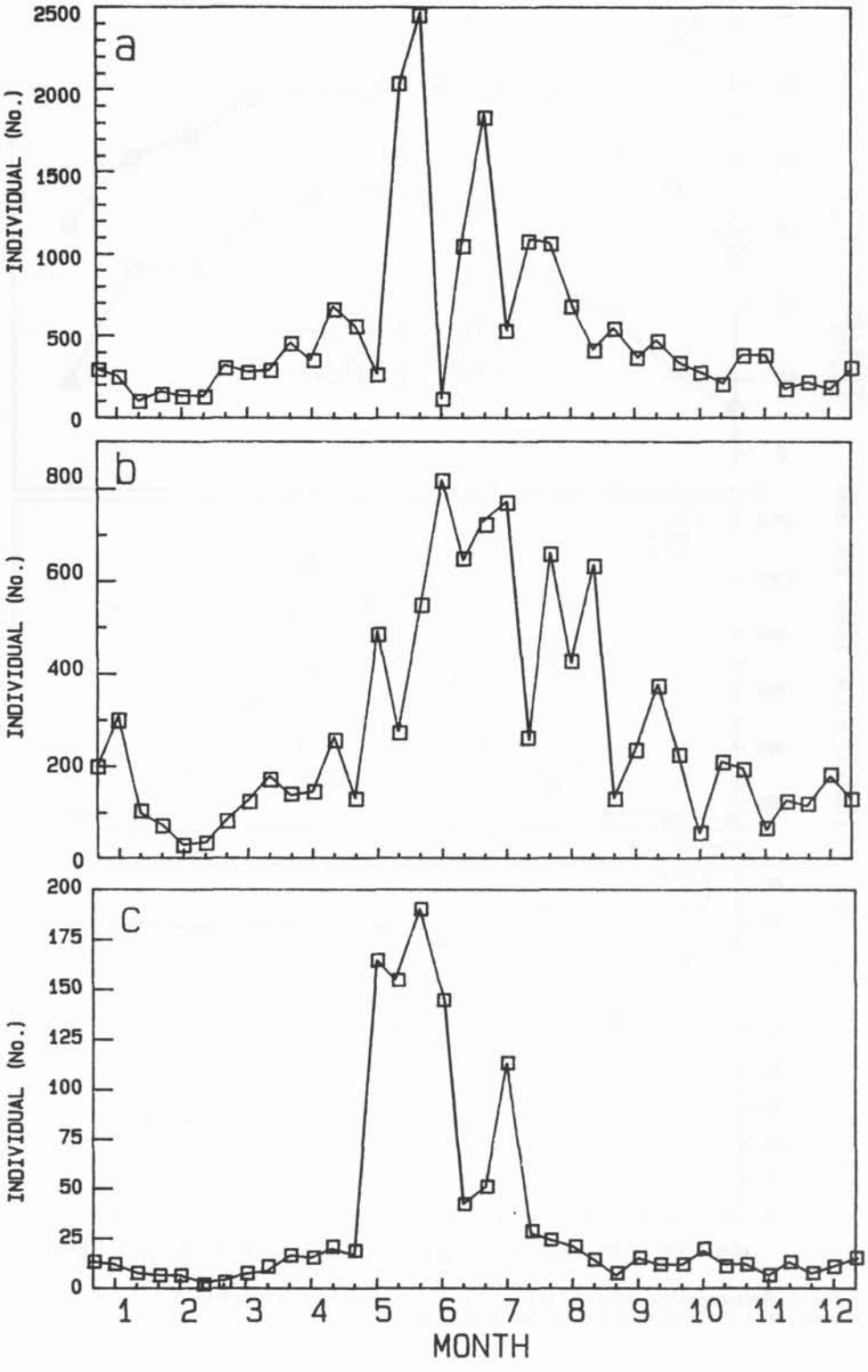

Fig. 1. Population dynamics of *Diaphorina citri* at Pokhara Horticulture Research Centre. Average no./10 twigs, A—Eggs, B—Nymphs, C—Adults.

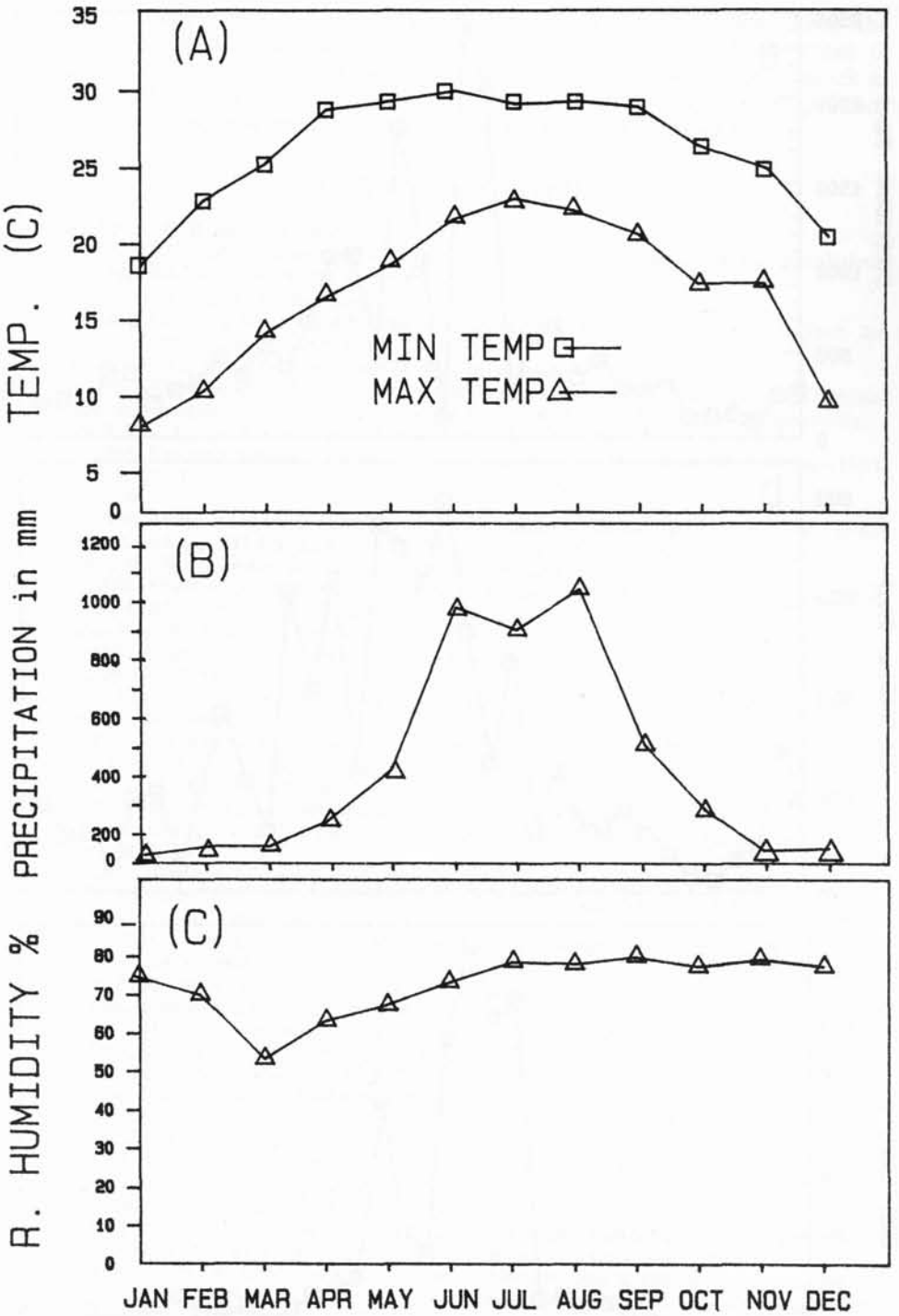

Fig. 2. Meteorological data of Pokhara Valley, 5 yr averages (1980-1985). A = Average Temperature, B = Precipitation, C = Relative humidity.

Coordinates of the Horticulture Research Station, Pokhara, are longitude 83.59° E, latitude 28.15° N, and the altitude is 935 m above sea level. The rainy season starts in the middle of June and ends by the end of October. Usually, there is little rainfall in winter. All these factors provide favorable conditions for *D. citri* during summer and, therefore, the population is very high.

During the rainy season, i.e., from July to October, the populations of adults decrease, although there are comparatively high numbers of eggs and nymphs. The authors have observed that heavy rainfall eliminates the eggs and nymphs, whereas the adults can hide on the lower surface of the leaves and twigs of inner-lower portion of the tree. Any measures for the control of *D. citri* should be undertaken mainly at the end of the rainy season.

The canopy rating conducted in 1981 in the mandarin block showed only some severely affected trees distributed throughout the orchard, whereas the rating in 1986 revealed that all the trees were severely damaged and were not economically useful. The overall progression of trees to the severely diseased stage was more than 12% per year. Since these trees were seedlings, it is obvious that only the vector *D. citri* was responsible for spread of the infection from diseased plants to healthy ones. Therefore, measures have to be taken to control the vector to overcome the CGD in Pokhara. Spread by propagation is not a factor where only seedling cultivation is practiced.

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